

# UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, ORANGE, NEW JERSEY.

## COMPOSITE METAL.

No. 850,881.

Specification of Letters Patent.

Patented April 16, 1907.

Original application filed March 30, 1905, Serial No. 252,933. Divided and this application filed January 20, 1906. Serial No. 296,955.

*To all whom it may concern:*

Be it known that I, THOMAS ALVA EDISON, a citizen of the United States, residing at Llewellyn Park, Orange, in the county of Essex and State of New Jersey, have invented 5 a certain Composite Metal, of which the following is a description.

In an application for Letters Patent filed March 30, 1905, Serial No. 252,933, I have 10 described an improved process for making a composite metal, and I propose herein to describe and claim the new product so secured.

The new composite metal consists of two or more metals physically admixed in such a 15 way that each metal exists as a practically integral sponge-like structure, the cells or pores of either metal being completely filled by the body presented by the other metal, whereby the entire bulk of the composite 20 structure as a whole will be continuously solid throughout. Such a composite metal is characteristically distinguished from any so-called "alloy" heretofore made, so far as I know, in the respect that it consists of 25 sponge-like interlocking masses, so that it becomes possible by dissolving or otherwise removing one of the metals to obtain a sponge-like integral mass of the other metal, whereas with ordinary alloys, owing to their 30 intimate molecular admixture, the attempt to dissolve any one of the constituents of the alloy results in the disintegration of the mass. This characteristic peculiarity of my improved composite metal makes it possible 35 to secure very beautiful sponge-like effects in various metals by first forming the composite metal and then removing one of the metals, and it also becomes possible to secure attractive effects in many arts where it is de- 40 sirable that two or more metals should be mechanically associated together.

The primary purpose for which I have used the composite metal referred to is for the production of scales, flakes, or foils of 45 nickel and cobalt for admixture with the active material in the negative electrode of my improved storage battery. As I have pointed out in application for Letters Patent filed March 30, 1905, Serial No. 252,935, good 50 contact with such active material and between the flakes or foils themselves is secured when metallic cobalt is used; but, as I have explained, it is undesirable to use metallic

cobalt alone, owing to the fact that its surface becomes oxidized by electrolysis and 55 might in time penetrate the whole mass, and hence it might be advisable to make use of a composite metal of cobalt and nickel. Such a composite metal serves to give excellent 60 contact, and the presence of the nickel there- 65 in prevents penetration of oxidation within the nickel-cobalt to a harmful extent; since the metallic nickel forms a continuous integral connecting-sponge, and therefore protects the cobalt from the possibility of in- 70 ward oxidation to any harmful extent.

Assuming a composite metal of nickel and cobalt to be manufactured for the purpose of forming scales, films, or foils for use in the make-up of my improved battery, I proceed 75 substantially as follows: A solution of sulfate of nickel and sulfate of cobalt is first obtained in the proper relative quantity to give to the resulting product the desired proportions of the two metals. Excellent 80 results have been secured with a composite metal containing sixty per cent. of cobalt and forty per cent. of nickel; but these proportions may be varied within quite wide limits. The solution of cobalt and nickel sulfates is 85 now added to a potash solution in excess of that necessary to precipitate the two salts, and the two solutions thus added are boiled, resulting in the precipitation of hydroxids of nickel and cobalt, which are allowed to 90 settle. The solution is now drawn off and the precipitated mixed hydroxids are washed successively until the mass is free of potash and sulfates. In this way I obtain a physically and intimately mixed mass of hydroxids 95 of the two metals in the desired proportion. The mixed hydroxids are now dried and screened into granules of substantially uniform size—for instance, those passing a thirty-mesh screen and arrested by a sixty- 100 mesh screen—after which the granules are subjected to the reducing action by hydrogen gas in a heated retort to reduce the hydrox- 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 198 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 298 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 398 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 598 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 698 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 798 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 898 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 998 1000

metal into fine scales or flakes--as is common in the art, for example, of making bronze powder. Preferably the flakes are annealed two or more times between the passes of the 5 rolling operation in an inert gas, such as hydrogen, at a red heat. After the flakes or foils are formed it is desirable in order to increase their bulk to pass them between very fine crimping-rolls, by which they will 10 be crimped, corrugated, or otherwise distorted, or between rolls of very small diameter, by which they will be curled or formed into minute spirals. These flakes or foils are added to the active material of the battery 15 in any suitable way, preferably by coating the active particles with a sticky material, such as molasses, and then admixing the same with the metallic flakes or scales, as I have described in an application for Letters 20 Patent filed March 30, 1905, Serial No. 252,931.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. A composite composed of two or more 25 metals, each in the form of a substantially integral sponge-like structure and said structures being engaged intimately together to constitute a solid mass, substantially as and for the purposes set forth.

2. A composite composed of cobalt and nickel, each in the form of a substantially integral sponge-like structure intimately engaging together to form a continuous solid mass, substantially as and for the purposes 35 set forth.

This specification signed and witnessed this 19th day of January, 1906.

THOMAS A. EDISON.

Witnesses:

FRANK L. DYER,

ANNA R. KLEHM